

February 2016 - [www.avitrader.com](http://www.avitrader.com)

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# Infrared Heating: An alternative approach to drying and curing aircraft parts

Infrared drying and curing can deliver more precise heat, greater speed and greater control than conventional convection processes.

For many drying and curing applications, the improved efficiencies of using infrared radiation (IR) – rather than conventional convection systems – are becoming increasingly important to aerospace manufacturers and MROs, who are always seeking new ways to trim costs and improve production efficiencies.

The availability of a wide range of IR heating elements, standard and custom heating panels, ovens and dryers into which heaters are placed (either new or retrofit) makes the conversion from convection to IR heating for a wide range of drying and curing operations easier than ever.

Used as a highly efficient heat source for many decades, IR heating systems are capable of drying and curing various coatings including primers and other undercoats, thermoset resins, polyurethane “wet look” coatings, urethane

and other clear coatings.

In addition to various paints and coatings, some aircraft industry composite materials specialists foresee that the finishing and repair of composite materials used in a variety of aircraft structural components could also benefit from the use of IR heating systems.

## Integral benefits of IR

The use of gas or electric IR rather than traditional convection systems enables manufacturers and rebuilders of aircraft parts to improve productivity and throughput by dramatically reducing drying and curing time – a benefit that should be particularly attractive to volume manufacturers of new components. Using IR heat, drying time is often reduced to mere minutes (depending on paint or other coating

requirements) versus many hours for convection drying systems – a reduction that can reach the 90+ percent range.

“Due to its vastly improved efficiency, drying and curing with infrared can greatly reduce energy costs,” explains Jesse Stricker, founder of Intek, Corp., a manufacturer that specializes in designing and building electric infrared heating elements, heaters, ovens and dryers. “Infrared heaters require little or no induced circulation (e.g., blowers, fans), are extremely ‘zone-able’ and less susceptible to humidity.”

Stricker adds that IR systems generally save on space. Convection ovens require blowers and ductwork to deliver heated air that serves as the medium of distribution from the heat source to the substrate. The heat from infrared heaters travels invisibly through the air directly to the substrate saving energy, time and



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Using more efficient infrared radiation (IR) ovens is becoming increasingly important to aerospace manufacturers and MROs.

space. This also makes them more versatile. Plus, in addition to directly heating surfaces, the heat from IR emitters can be reflected onto parts, providing added drying coverage, thereby making additional energy savings and processing efficiencies possible.

"IR drying and curing is cleaner, providing a higher quality finish on coated products," Stricker explains. "Because IR heat transmission is line-of-sight and doesn't depend on large fans or blowers - which are frequently required for conventional convection systems - contamination on the coated surface is virtually nonexistent. This eliminates product rejects and reworking."

### Better control, better results

One of the primary reasons why aerospace parts manufacturers and MROs are converting to IR drying and curing is that it is easier to monitor and control than many convection heating systems.

"It is necessary to understand the behavior of the heat coming from a source, and the fact that the heat must be monitored," Stricker explains. "Each heat zone, for instance, has its own temperature control and thermocouple, the thermoelectric device used to measure the temperature. In the case of infrared heating technology, this allows our zoning to be very tightly controlled. This provides a full-surface reference of the actual IR emitter temperature; you can correlate that by running tests on customer's actual parts prior to presenting

our design. This way, you know, for example, 800 degrees at the emitter correlates with 350 degrees at the part, over a specific period of time."

Another critical difference, in drying and curing of paints and other coatings, well-defined heating zones are often required. Multiple zones are trickier with convection heating because it is more difficult to monitor and control multiple blowers and heat sources. IR heating is much more "zoneable," because each emitter module is a kind of building block of the oven or array, it is much simpler to create as many zones and controls as required to achieve the desired results.

Yet, there are drying and curing applications where convection heating can be combined with IR panels to create a hybrid system. One example of such a system is when IR is used at the beginning of a process line to preheat the products before going to a convection oven for drying. This hybrid system may be advantageous when the products have "hidden" surfaces that can be dried more evenly by convection heating. In some instances hybrid systems require a small IR heating chamber to be added before the convection oven; in others, relatively compact IR heaters can be placed within the first section of the convection oven.

### Drying and curing of composites

Many of the same benefits, particularly accurate control of drying/curing profiles and flexibility of configuration also apply to using IR

systems for composite materials.

These layered or sandwiched carbon-based materials are often used to improve the structural properties of aircraft fan cowls, undercarriage doors, trailing-edge wedges on flight control surfaces, and fuselage undercarriage structural components. Because they are considerably lighter in weight than traditional metals such as aluminum alloys, composites also promise to add significant fuel savings to next generation aircraft such as the Boeing 787 Dreamliner.

Michael Donnelly, an aerospace composite repair specialist, views IR curing of both new and refurbished aircraft components and assemblies using composite materials as providing many of the same benefits as the drying and curing of paint and other surface coatings.

"The tolerances for composite temperature profiles used for curing parts are normally extremely tight from start to finish," Donnelly says. "I have seen convection ovens constructed for that purpose that have ended up being an expensive misstep. On the other hand, the use of a correctly-configured oven or even external heating arrays using highly controllable IR heat sources to tightly match various surfaces may be able to meet those tight profiles more consistently and also accelerate the speed and throughput of curing."

Source: Power PR